
Problem Management: What Happens When Risks Become Problems?

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Introduction

- **Introduction of Presenters**
- **History of Problem Management Effort**
- **Other Current Efforts in this Area**
- **Process for Writing the Document**
- **Approach for Creating Problem Management Process**
- **Status of Draft Problem Management Document**

Presenters

- **Who we are**

- ✍ Pamela F. Richardson

- Currently serving as Aeronautics Mission Assurance Manager at NASA HQ

- ✍ Michele T. King

- Engineer/Risk Analyst at Futron Corporation

- **How we tie in**

- ✍ With funding from the NESC, Futron was tasked to work with John Tinsley to create a document to respond to Diaz Action #19

- ✍ Pam Richardson works under the direction of John Tinsley and was tasked to collaborate with Futron on the writing of this document

- **What we were doing during this effort**

- ✍ Developing a Problem Management process to assist Program and Project Managers in managing problems, nonconformances, and anomalies

- ✍ Writing a guidance document entitled “Procedural Guidebook for NASA Program and Project Management of Problems, Nonconformances, and Anomalies”

History

- **March 20, 2004**

- ✍ NASA Deputy Administrator, Fred Gregory, released “The Implementation of the NASA Agency-Wide Application of the Columbia Accident Investigation Board Report: Our Renewed Commitment to Excellence.” The plan established an approach for implementing Agency-wide actions defined by the Diaz Team. Page 23 of the plan states “Review and consider reinstituting post-Challenger policies and processes for problem reporting and trend analysis.”

- **Collaboration**

- ✍ NESC tasked Futron to collaborate with NASA HQ in order to develop a NASA guidance document
- ✍ Received input from NESC-SMA Working Group members, the NESC SEO office, OSMA and others

- **Progress**

- ✍ Topics: problem identification, significant problem reporting, problem resolution, trend analysis, and recurrence control
- ✍ Initially proposed to be included in the rewrite of NPR 8000.4, “Risk Management Procedures and Guidelines”
- ✍ Later proposed to be a stand-alone guidebook

- **Requirements**

- ✍ Incorporate heritage trends analysis techniques from previous NASA guidance and new techniques developed over the last 15 years
- ✍ Include data mining techniques in order to make the trending activities more efficient

Collaboration in Writing the Document

- **Ken Cameron (NESC)**
- **Vicky Parsons (Data Mining and Trending Working Group, NESC)**
- **Bob Biel (Data Mining and Trending Working Group, NESC)**
- **Pam Richardson (OSMA)**
- **John Tinsley (OSMA)**
- **Mike Canga (IPAO)**
- **Dale Huls (MSFC Problem Reporting and Corrective Action, JSC)**
- **Working Group at NASA Headquarters, August 16, 2005**

- **Objective**

- ✍ To improve safety by performing in-depth engineering assessments, testing, and analysis to uncover technical vulnerabilities and to determine appropriate preventative and corrective actions for problems, trends or issues within NASA's programs, projects and institutions

- **When**

- ✍ Created in the aftermath of the Space Shuttle Columbia accident
- ✍ Became operational in November 2003

- **Where**

- ✍ Located at Langley Research Center, Hampton, Virginia
- ✍ NASA Headquarters Function

- **Why**

- ✍ To serve as an independent technical resource for NASA managers and employees

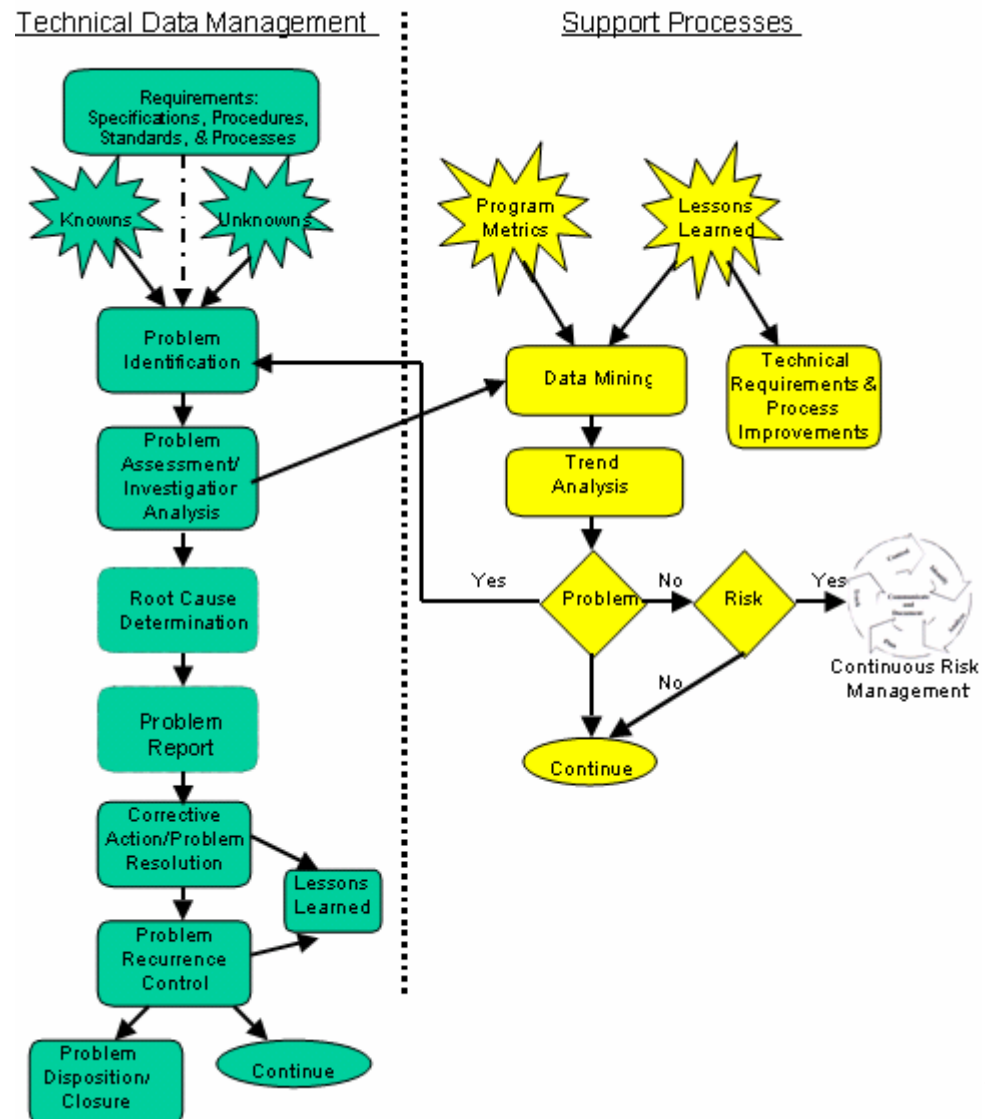
Key Efforts and Activities

What is a Problem?

- **Any circumstance that fits or is suspected of fitting one of the following categories:**
 - ✍ Failure, including conditions that would result in waivers
 - ✍ Unsatisfactory condition
 - ✍ Unexplained anomaly (hardware or software)
 - ✍ Overstress or potential overstress of hardware
 - ✍ In-flight anomaly
 - ✍ Any nonconformance (hardware, software, or process) that has been shown by a trend analysis to need recurrence control
- **A realized risk**
- **A risk with a likelihood of 100%**

Framework

- The problem management process began with a framework, more specifically with a flow diagram:

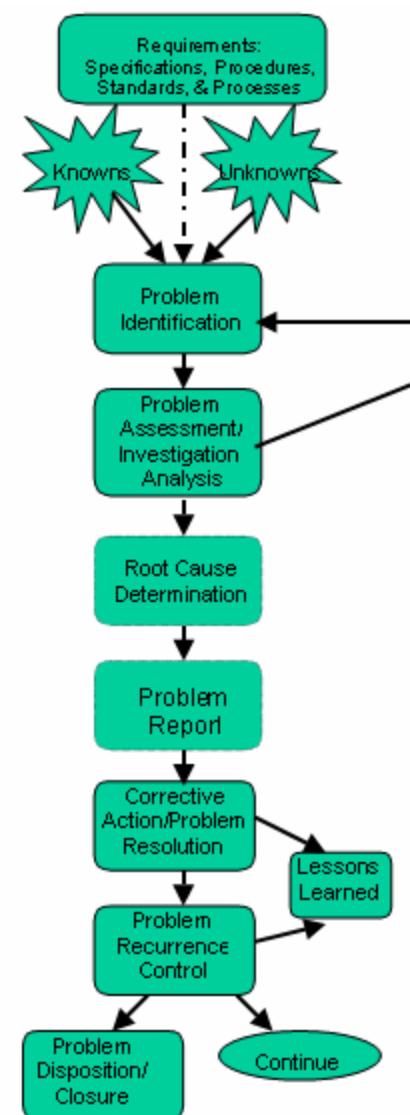


Two Parts

- The overall process was split into two sections:
 - ✍ Technical Data Management
 - ✍ Support Processes

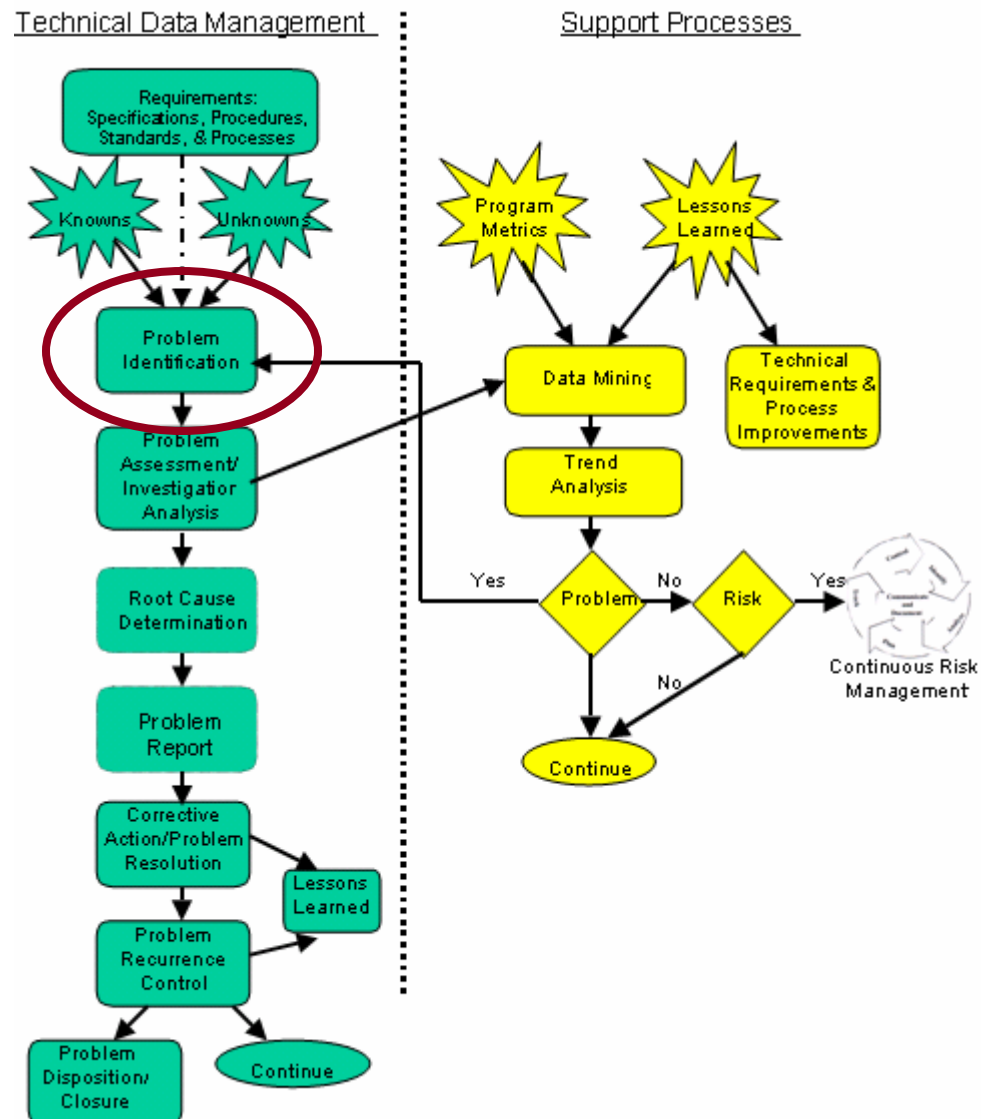
Technical Data Management

- This section includes the key steps for problem, nonconformance, and anomaly management
- It describes procedures and actions to be followed when a problem arises
- It includes elements of three of the seventeen process requirements outlined in NASA Systems Engineering Processes and Requirements, NPR 7123.1



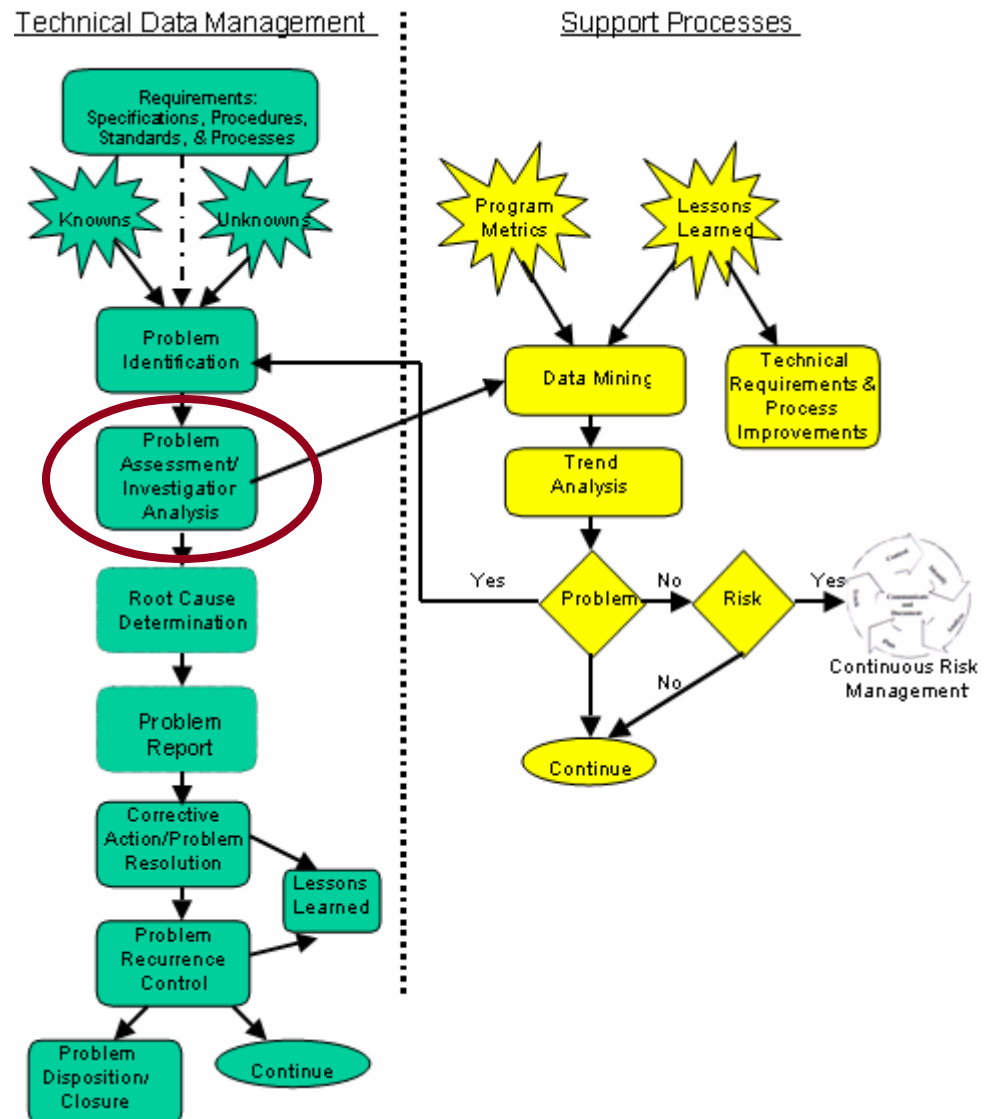
Problem Identification

- This step involves gathering information from the projects so that problems can be described and measured
- Early identification of problems leads to improved safety and quality, as well as a substantial savings of resources, such as cost, schedule, and performance



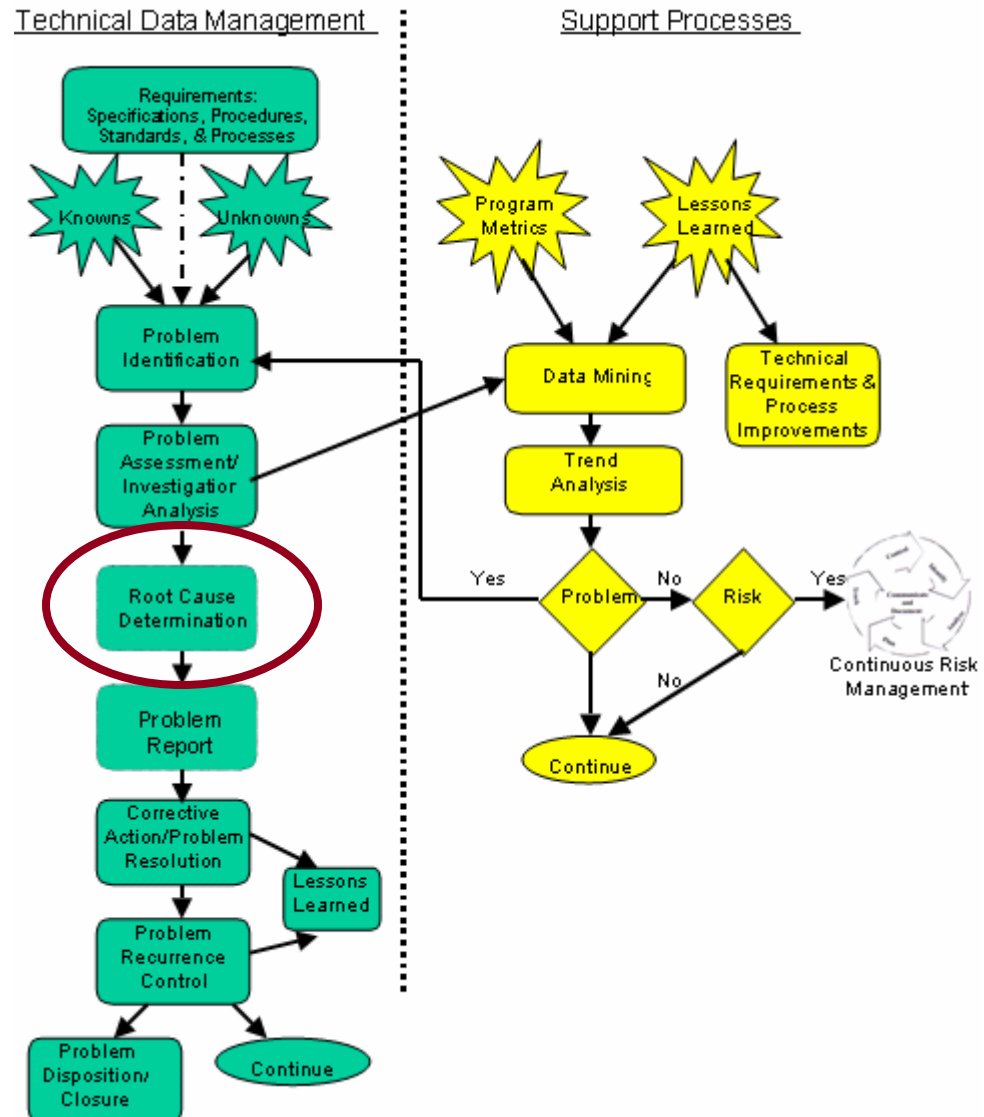
Problem Assessment/ Investigation Analysis

- In this process, problems are examined in further detail to determine their extent
- Problem assessment may reveal how problems relate to each other
- Problems are classified or grouped with similar problems
- After they are classified, it is important to prioritize problems in order to determine which ones should be dealt with first
- The guidebook offers methods of prioritization, as well as examples of investigation analysis and failure analysis



Root Cause Determination

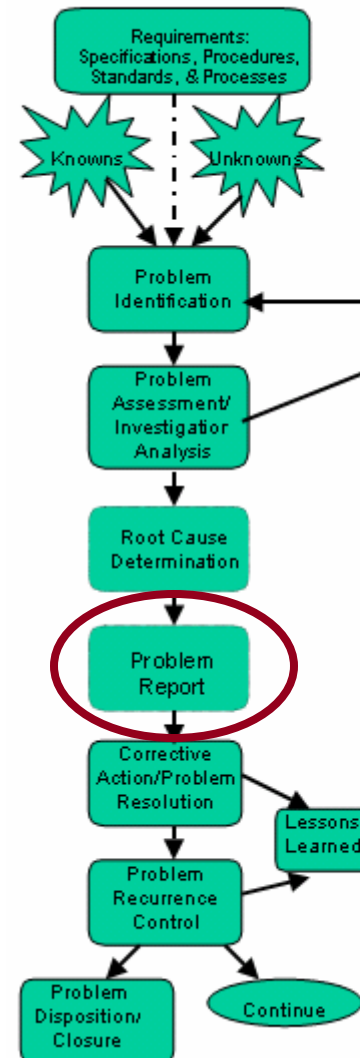
- Root causes of problems need to be defined completely so that adequate corrective action can be implemented or an approved standard repair put in place
- The guidebook offers examples of root cause determination



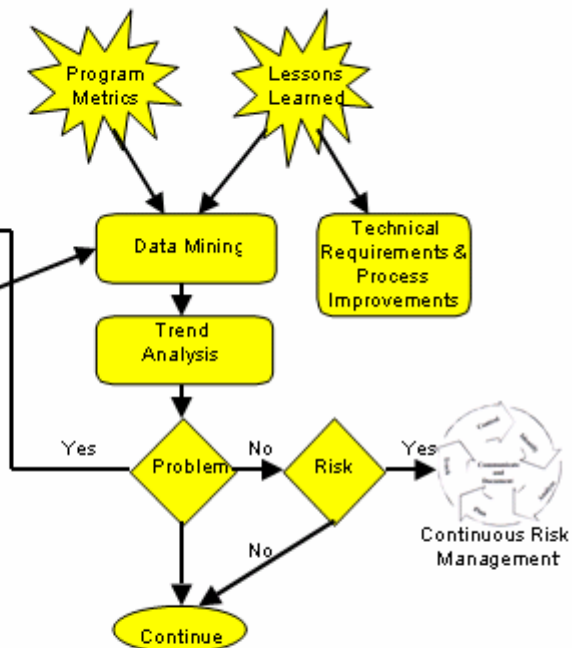
Problem Report

- Problem reporting can take any of several forms:
 - ✍ Formal reports
 - ✍ Presentations
 - ✍ Memos
 - ✍ Other
- One example of a problem reporting system used within the Agency is Problem Reporting and Corrective Action (PRACA)
- The guidebook offers guidance for a problem report

Technical Data Management

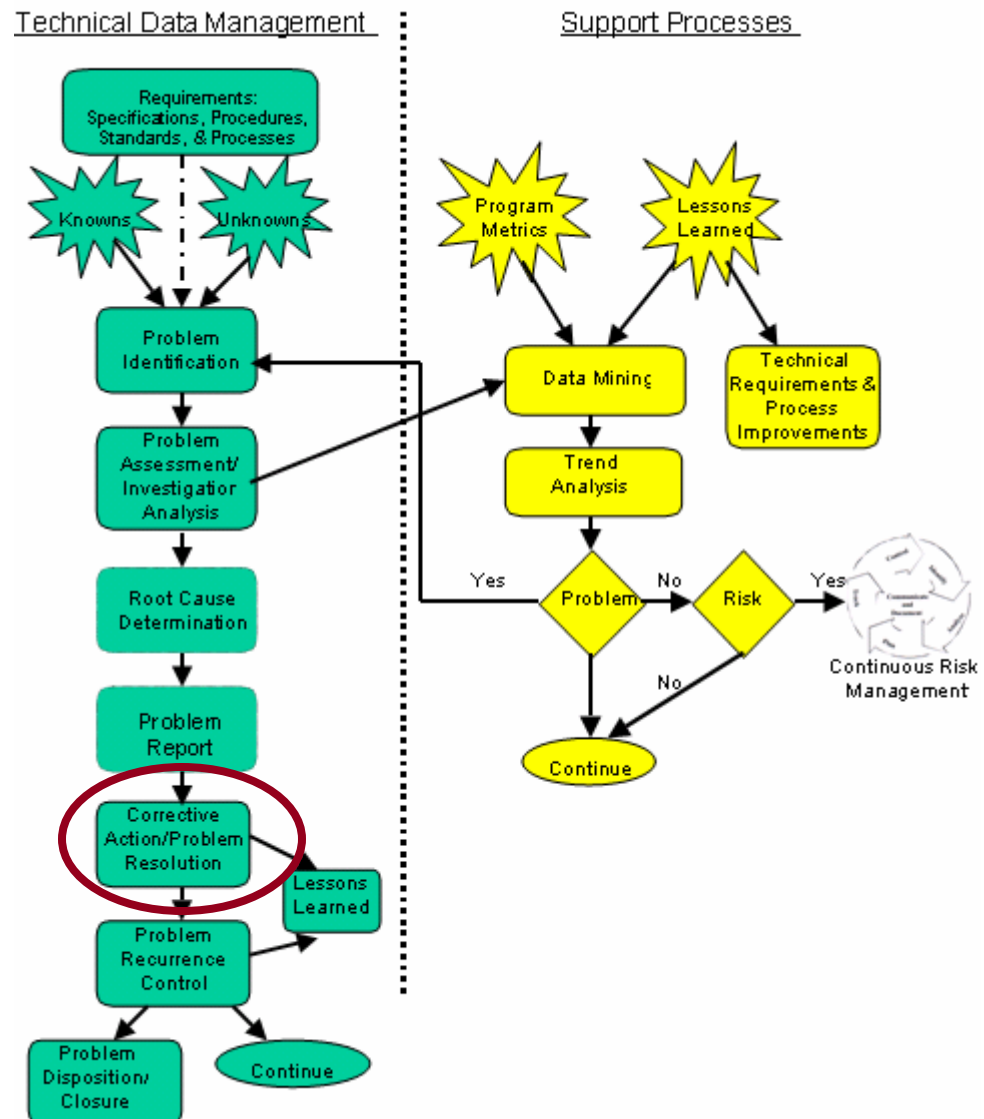


Support Processes



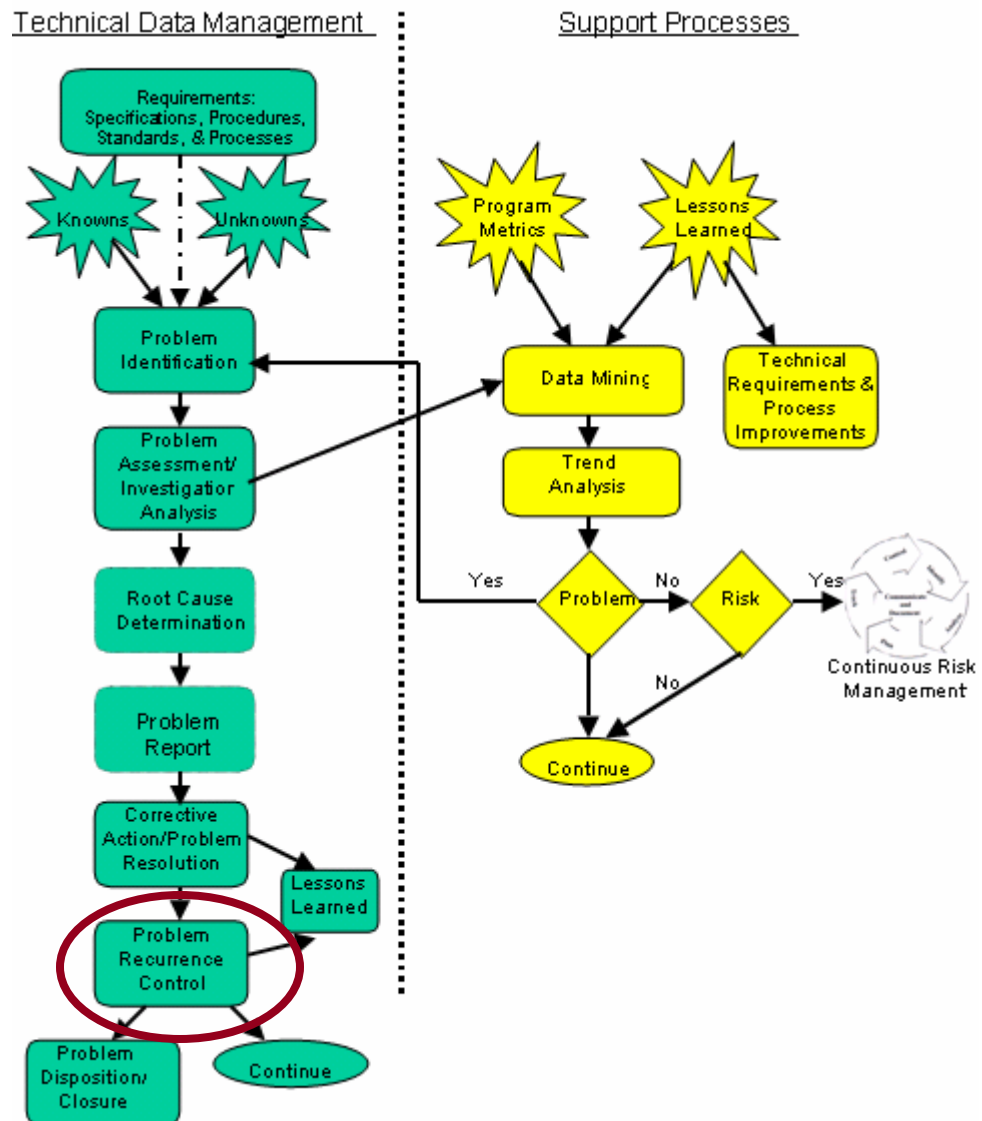
Corrective Action/Problem Resolution

- Corrective action requires the following:
 - ✍ Develop a plan of action
 - ✍ Assign the problem to a person capable of resolving it
 - ✍ Determine the approach to resolve the problem
- Problem resolution involves investments or trade-offs, which require careful consideration
- The guidebook offers an example of corrective action



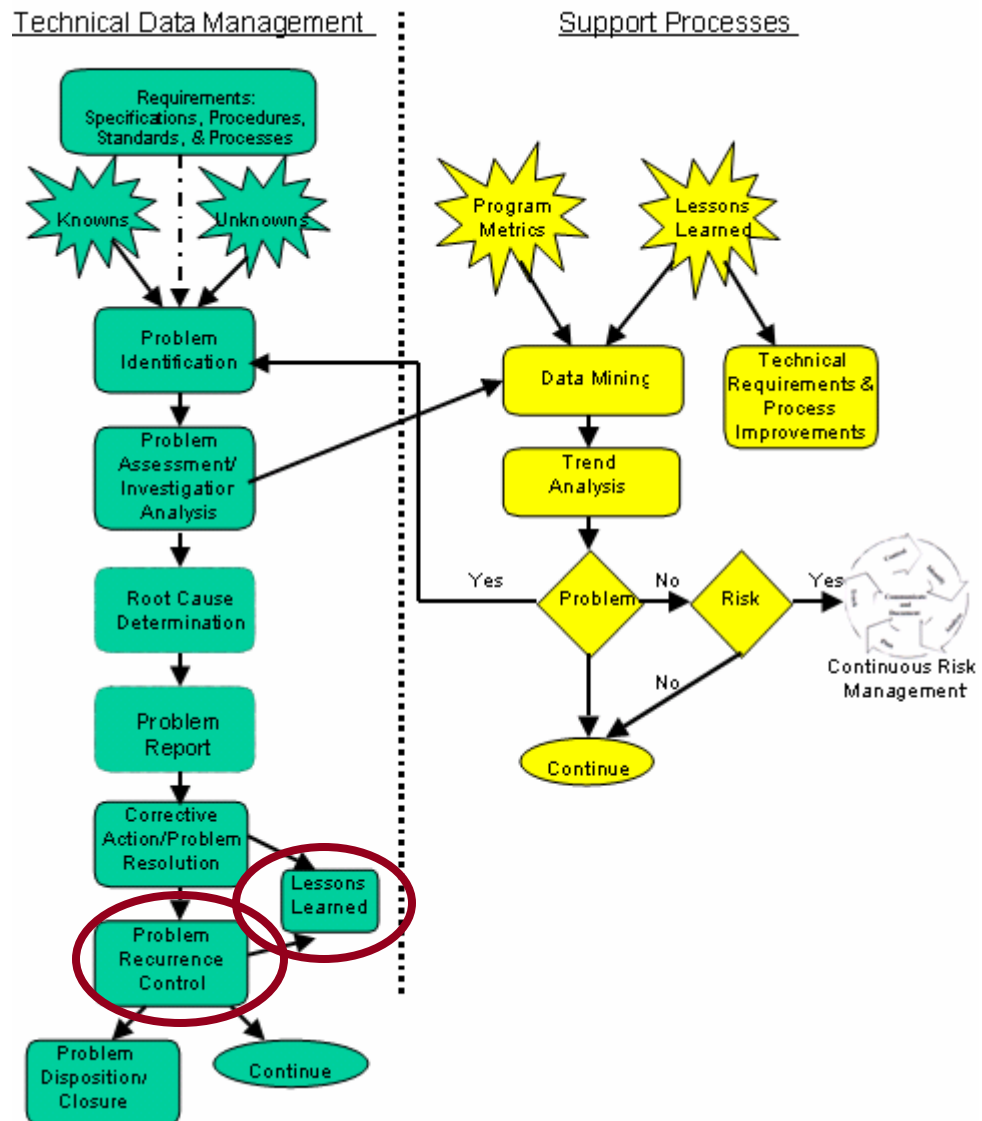
Problem Recurrence Control

- Recurrence control is preventative action beyond remedial action taken to preclude or minimize the recurrence of a problem
- The guidebook offers guidance for problem recurrence control



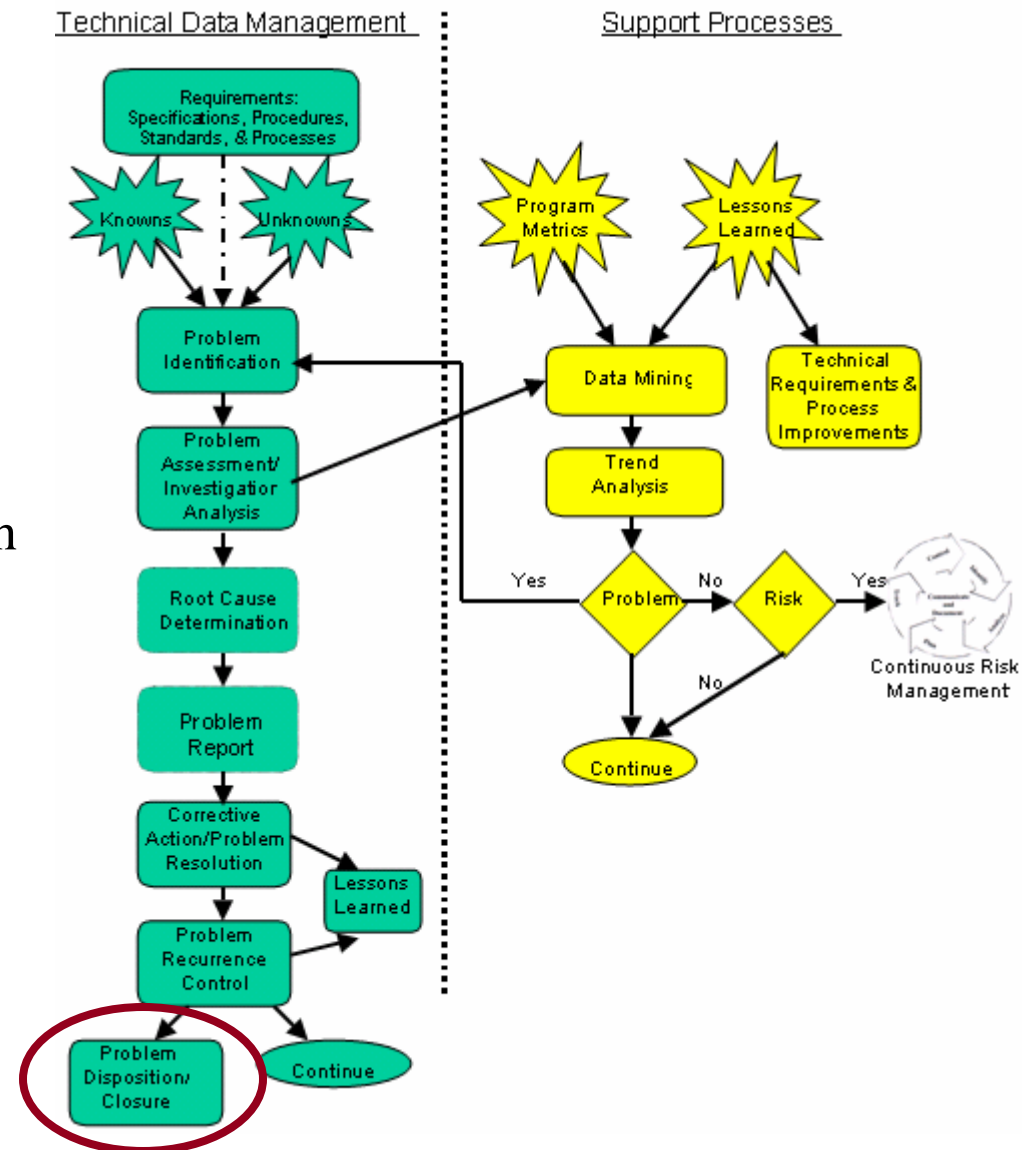
Problem Recurrence Control and Lessons Learned

- Problem recurrence control involves capturing lessons learned during the process of problem resolution, ensuring the communication of these lessons across the entire Agency and implementing corrective actions to ensure recurrence control
- Lessons learned are captured in the Agency's Lessons Learned Information System (LLIS)



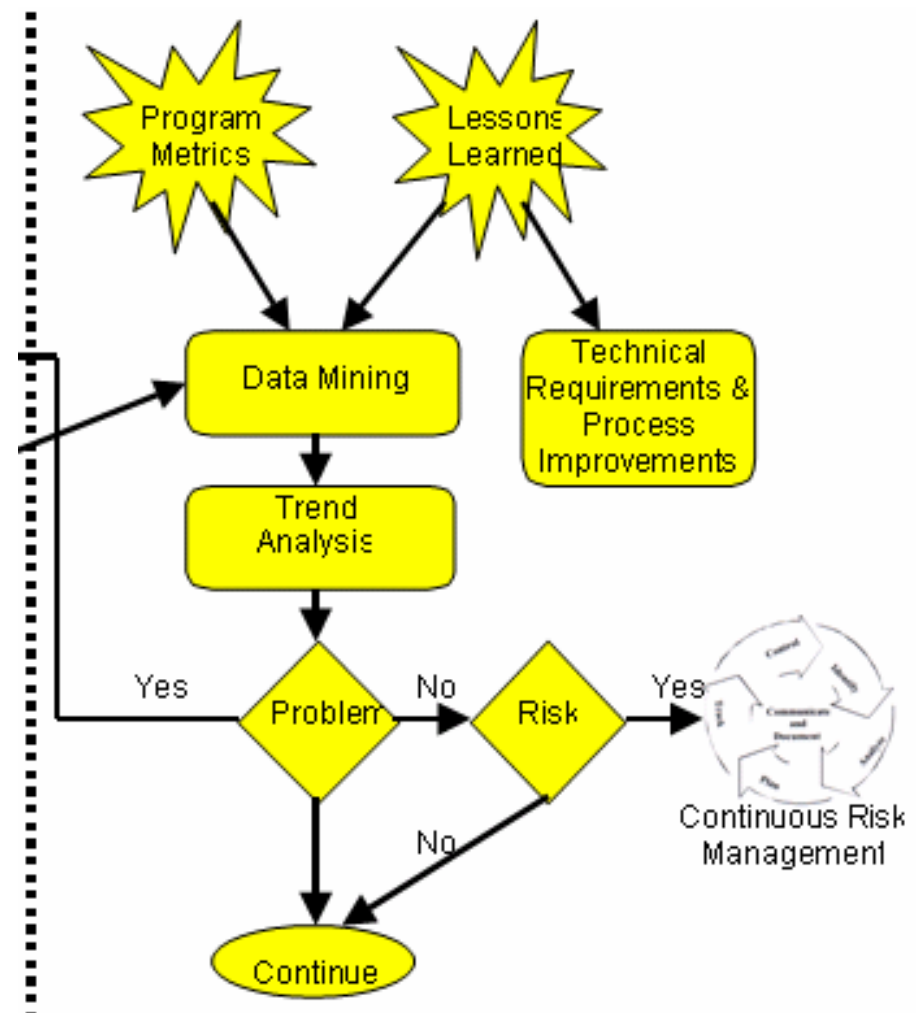
Problem Disposition/Closure

- After appropriate steps have been taken to resolve the problem, it is important to properly disposition the problem
- Proper disposition aids in tracking the problem through its lifecycle to completion
- The guidebook offers guidance for the disposition and closure of problems



Support Processes

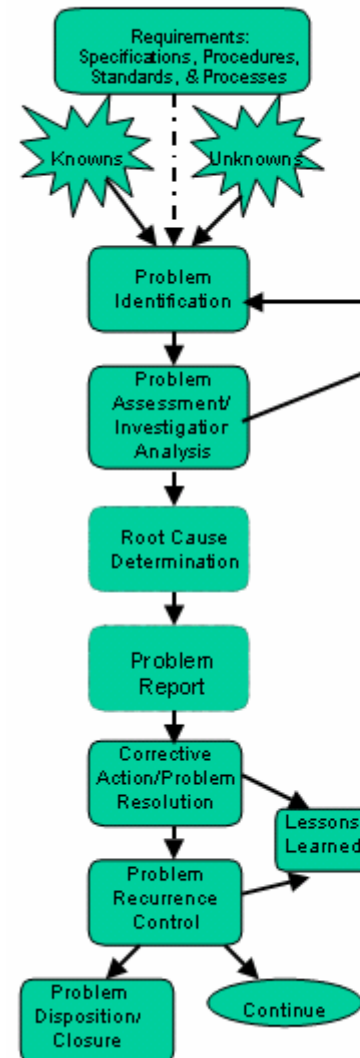
- This section includes the implementation of analysis tools and techniques for problem management
- Analyses assist decision makers in making better and more informed decisions in complex situations under a high degree of uncertainty
- The quality of decision is measured by:
 - ✍ Their expected consequences
 - ✍ The uncertainty of the consequences
 - ✍ The stated preferences of the decision makers



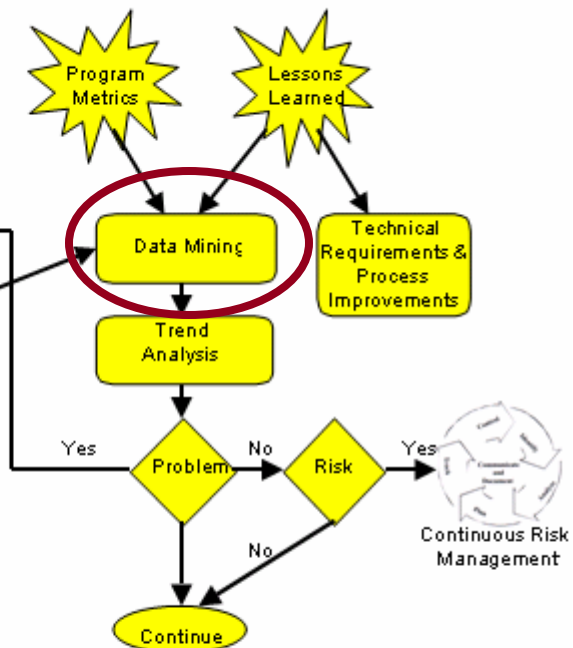
Data Mining

- NASA has tasked all programs and projects to perform trending as one method to uncover adverse data patterns
- Data mining is the nontrivial extraction of implicit, previously unknown, and potentially useful information from data
- Once the data mining effort discovers something, the subject matter experts are required to determine if the “something” actually constitutes a potential problem
- Data mining should be the first step in the overall trending process
- The guidebook offers additional information on data mining theory

Technical Data Management



Support Processes

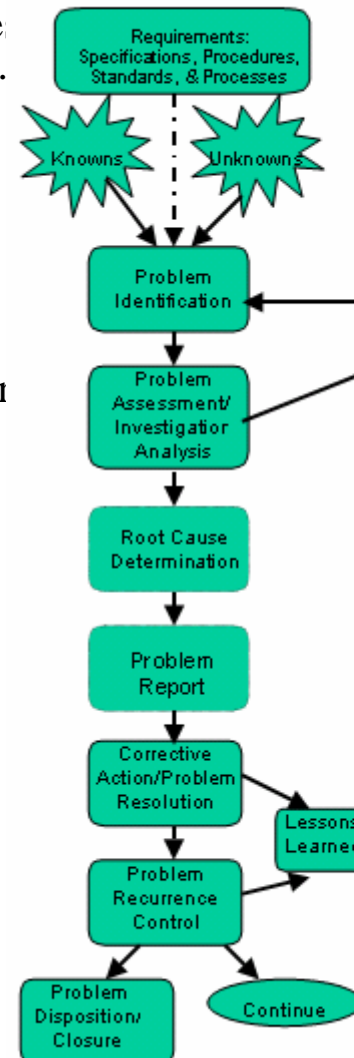


Trend Analysis

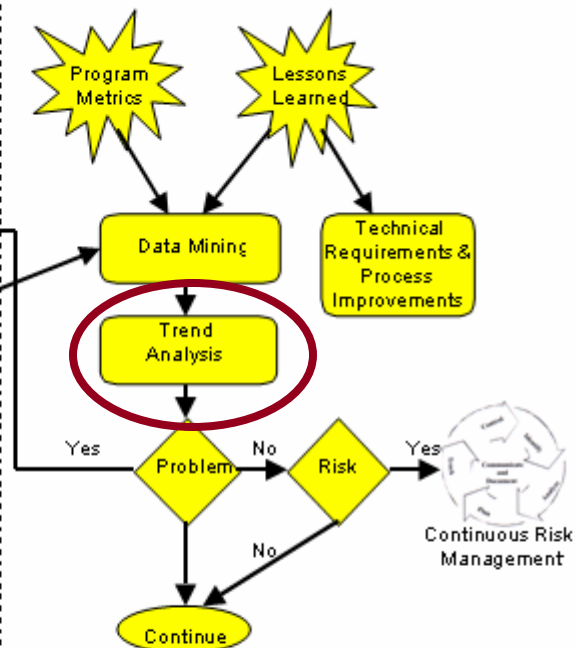
- Trend analysis is an element of engineering investigation that provide continuous review of program factors.
- It has two prime characteristics:
 - ✍ Investigation of actual events
 - ✍ Comparative assessment of multiple events
- Trend analysis is also used to discover and confirm correlations between diverse factors
- NASA trend analysis comprises four interrelated elements:
 - ✍ Performance
 - ✍ Problem
 - ✍ Supportability
 - ✍ Programmatic

(*Organizing trend analysis into these specific groupings is a NASA-unique approach)
- The guidebook offers examples of trend analysis

Technical Data Management



Support Processes



Current Efforts in Problem Management

- **Data Mining and Trending Working Group NESC**

- ✍ Team members include NASA, contractors, and students
- ✍ Aeronautics and Space Systems have vast data stores; the goal is to develop a system that will automatically discover recurring anomalies, given a stack of 100,000+ reports

- **Problem Reporting and Corrective Action (PRACA)**

- ✍ PRACA is used at several NASA centers
 - Marshall Space Flight Center PRACA was established to assure accurate tracking of problems and problem resolution for shuttle-related MSFC hardware elements. It is used to record significant problem information used for problem tracking and resolution analysis; for assurance of problem disposition or closure as required for Space Shuttle mission risk control; and for problem trending to assure adequacy of problem closure and to highlight areas needing attention for increased research and possible redesign. It is also used as a data source for transfer of MSFC problem information to the Shuttle Program Office Program Compliance Assurance and Status System (PCASS) Integrated Problem Assessment System (IPAS)

Status of Draft Guidebook

- Comments to the draft guidebook by the NASA Centers are currently undergoing review by Pamela Richardson at NASA Headquarters

Summary and Conclusions

Summary

- The document will act as a guidebook to assist program and project managers in dealing with problems when they arise
- The information provided in the document is an overview of the steps that a program or project manager should take
- The appendices provide examples and an overview of mathematical models to help manage and learn from problems

Acknowledgments

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